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Virgin Atlantic Airways Ltd., The Office, Manor Royal,  
Crawley, West Sussex RH10 2NU (GB).

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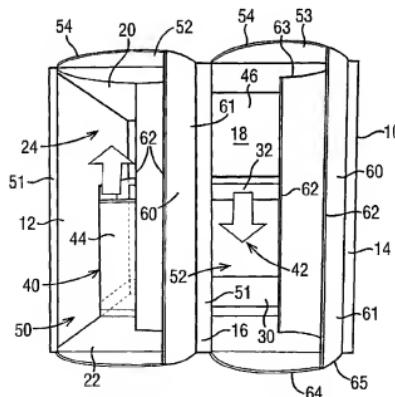
(74) Agents: CRUMP, Julian, Richard, John et al.; f/ Cleve-  
land, 40-43 Chancery Lane, London WC2A 1JQ (GB).

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(54) Title: AN ACCOMMODATION UNIT FOR A PASSENGER VEHICLE

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(57) Abstract: An accommodation unit for a passenger vehicle, particularly an aircraft, which comprises a housing (10) defining an interior space, two bunks (30,32) accommodated within the space in vertically spaced relation to each other, internal partitioning means for partitioning the internal space into two separate, non-connecting chambers, each of said chambers containing a respective one of said bunks and enclosing the full-height area juxtaposed the respective bunk, and separate access means associated with each chamber to provide separate entrances (50,52) to the chambers.



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## AN ACCOMMODATION UNIT FOR A PASSENGER VEHICLE

The present invention relates to an accommodation unit for a passenger vehicle, particularly an aircraft. In particular, the present invention provides an 5 accommodation unit comprising a full-length flat bed for a passenger to sleep on during the course of a voyage or flight.

In an era of an increasingly global economy, there are many people who make frequent, long distance flights. For instance, there are a substantial number of business people who make weekly transatlantic flights. The 10 problems associated with jet-lag are well-known and documented, and for such people there is an increasing need for them to be able to sleep well and comfortably during the course of a flight. A conventional aircraft passenger seat is adapted to recline to a certain extent, but many people find it difficult or impossible to sleep properly in such a seat. For many people, it is only 15 possible to sleep properly on a flat, substantially horizontal surface.

Accordingly, there has been a trend in recent years for passenger airlines to provide improved passenger seats which are capable of reclining to provide a flat or almost flat surface on which a passenger may sleep.

Thus, US-A-5788183 discloses an aircraft seat in which the backrest can 20 be reclined and the leg rest elevated to respective positions substantially co-planar with the seat pan, thereby to form a flat surface.

GB-A-2295962 discloses an aircraft seat for use in a first class area of an aircraft cabin comprising a fixed housing, a seat with a back portion contained within the fixed housing and a seating portion, and a trolley 25 associated with the seating portion and driving means for driving the trolley to move the seating portion between a retracted position in the housing and an extended position such that as the seating portion is moved, the back portion is caused to move between substantially upright and reclined positions, wherein a

substantially flat surface for sleeping on is formed by the back and seat portion when the back portion is in the reclined position and the seat portion is in the extended position.

- US-A-5992798 discloses an aircraft seat comprising a housing and a  
5 seat portion having a backrest, seat pan and a leg rest in which the back-rest  
may recline by driving the backrest downwardly and forwardly within the  
housing and simultaneously elevating the leg rest such that the seat portion  
unfolds to form a substantially flat surface for sleeping on which extends under  
a seat in front.
- 10 Whilst passenger comfort is a desirable objective of each of the above-referenced prior art publications, another paramount object is to optimise the use of space in an aircraft cabin. The aircraft seats described in the above-referenced prior art documents are all currently in commercial use and can be interconverted between a sitting configuration and a sleeping configuration.
- 15 The seat of US-A-5992798 is particularly notable in that there is substantially no dead-space between adjacent rows of seats.

- Early prior art disclosures, which date from a time when perhaps there was a lower commercial imperative to optimise the use of cabin space are  
DE-A-714911 which discloses a vehicle carriage which is sub-divided into a  
20 bottom storey and a top storey by a diagonal partition wall. Each storey comprises a plurality of juxtaposed passenger compartments that are divided from each other by partition walls and each compartment accommodates a reclining seat. According to DE-A-1714911, that arrangement may be used, for example, in coaches, commercial aircrafts and airships.
- 25 US-A-2124003 discloses an aircraft cabin having a sleeping berth consisting of a plurality of sections forming an aisle, each of said sections comprising in combination two pairs of seats, means for transforming said seats into partitioned twin lower berths, means enclosing said twin lower berths, an

- upper panel hingedly connected to the wall of the aircraft cabin to form partitioned twin upper berths, means enclosing said twin upper berth, and an individual entrance means from said aisle to each of the said berths. As with the more recent disclosures mentioned above, therefore, US-A-2124003
- 5 discloses a construction that comprehends transforming aircraft passenger seats into bunks for sleeping. A disadvantage of the arrangement of US-A-2124003, however, is that whilst separate entrances are provided for each of the upper and lower berths, there is no provision of a private space where a passenger may change into sleeping attire, other than within a berth itself which has a
- 10 restricted headroom.

Accordingly, an object of the present invention is to provide a novel accommodation unit for a passenger vehicle, particularly an aircraft, which provides a flat, substantially horizontal sleeping surface for a passenger.

Another object of the present invention is to provide an accommodation 15 unit for a passenger vehicle which optimises the use of space in a vehicle cabin such that the accommodation unit may be commercially viable.

A further object of the present invention is to provide an accommodation unit for a passenger vehicle which includes a sleeping surface for a passenger and a private changing area within which a passenger may 20 change conveniently into or out of sleeping attire.

According to one aspect of the present invention therefore, there is provided an accommodation unit for a passenger vehicle, particularly an aircraft, which accommodation unit comprises an housing defining an interior space, two bunks accommodated within that space in vertically spaced relation 25 to each other, internal partition means for partitioning the interior space into two separate, non-connecting chambers, each of the chambers containing one of the bunks and enclosing a full-height area juxtaposed the respective bunk, and separate access means associated with each chamber to provide separate

entrances to the chambers.

The accommodation unit of the present invention thus optimises the use of space within an aircraft cabin by providing two bunks which are mounted one over the other and which, at the same time, provides a convenient, full-height private area associated with each bunk within which a passenger may change. The privacy of each passenger is assured by the partition means that completely separate the two chambers from each other and by the separate access means that are provided for each chamber.

The accommodation unit of the present invention may be suitably manufactured from any relatively light-weight, composite construction material that is flame-proof and fire-proof and is thus authorised for use on passenger aircraft. Typically the accommodation unit further comprises a roof that extends continuously over both chambers. The accommodation unit may also comprise a floor which may extend at least under the full-height areas. The accommodation unit of the present invention may conveniently be manufactured as a substantially self-supporting, pre-fabricated unit that merely requires to be secured in place in an aircraft cabin. Alternatively, the accommodation unit of the present invention may comprise a limited number of pre-fabricated modular components that maybe easily assembled *in situ* and secured to the aircraft infrastructure.

The accommodation unit of the present invention is typically provided with fastening means for fastening the unit to seat tracks of the kind conventionally found in aircraft and other vehicles.

Said bunks may be substantially the same size and shape as each other and may be vertically substantially aligned within the accommodation unit.

A top bunk and a bottom bunk may be provided. In some embodiments, the two bunks may be arranged in opposite "head-to-toe" relation to each other.

In some embodiments the top bunk may be at least partly supported by the housing. Preferably, the top bunk may be formed integrally with the housing. Of course, both the bottom and top bunks will usually be provided with soft coverings, including a mattress and bed clothes.

5 Preferably the top bunk is disposed contiguous an internal surface of the housing horizontally partitioning the two chambers. Thus, the top bunk may form a partition dividing the two chambers. Thus, where the top bunk is disposed contiguous an internal surface of the housing, vertical communication between the two chambers is precluded. Said accommodation unit may further 10 comprise vertical partition means for vertically partitioning the chambers from each other, thereby to isolate each chamber from the other.

Said bunk may comprise two opposing longitudinal sides and two opposing ends. Thus, each of the bunks may have the shape and size of a conventional single bed. Preferably, each bunk is at least 183mm (6') in length 15 and at least 76cm (25") in width.

In some embodiments, one of the longitudinal sides may be disposed contiguous an internal surface of the housing. Similarly, one of the ends of the top bunk may be contiguous the internal surface of the housing. Said full-height areas may be disposed adjacent one another to the other longitudinal 20 side of the top bunk, and said vertical partition means may comprise first dividing means for dividing the full height area from each other, and second dividing means for dividing the bunk of each chamber from the full height area of the other chamber.

In some embodiments, both of the longitudinal sides of the top bunk 25 may be continuous an internal surface of the housing. Similarly, both the ends of the top bunk maybe contiguous an internal surface of the housing. Said full-height areas may be disposed to opposing sides of the bunk and said vertical partition means may comprise first and second horizontally and vertically

spaced, substantially vertical partitions, disposed respectively to opposing sides of the bunks for vertically partitioning the bunk of each chamber from the full-height area of the other chamber.

Preferably, said full-height area has a headroom of at least 1.83m (6').

- 5 In some embodiments, said full-height area may have a headroom of at least 1.98m (6'6"), for example 2.13m (7').

In a particular aspect of the present invention, said housing comprises a bunk module that accommodates said two bunks and two separate, full-height changing modules that are each adapted to be fixedly secured adjacent to the  
10 bunk module, wherein the bunk module comprises wall means that completely surround the two bunks, except for two vertically spaced openings that provide access to each of the bunks respectively, and each of said full-height changing modules comprises wall means that surround and define the respective full-height area and define an open end that is adapted to butt against the bunk  
15 module to close the respective chamber and to connect with the respective opening to allow access from the full-height area to the respective bunk; each of said full-height modules further comprising access means to allow access to the respective chambers. Said changing modules may be positioned adjacent one another to the same side of the bunks or, alternatively, they may be  
20 positioned on opposing sides of the bunks.

According to another aspect of the present invention there is provided access means for an accommodation unit in accordance with the present invention, comprising means defining a doorway, an arcuate rotatory door and means for mounting said door in said doorway for rotation about a first axis  
25 between a first occupied closed position and second vacant closed position through a third intermediate open position, said door having an arcuate cross-section in a plane orthogonal to the first axis, the arrangement being such that in the first occupied closed position, the door closes the doorway and protrudes

outwardly of the doorway thereby enlarging volume of the respective chamber; in the second vacant position the door closes the doorway and protrudes into the respective chamber, thereby reducing the volume occupied by the accommodation unit; and in the third open position, the door defines a 5 passageway with the doorway to allow access to the chamber.

When incorporated in an accommodation unit in accordance with the present invention, said first axis is usually oriented substantially vertically and the rotatory door is arcuate in a horizontal plane. In some embodiments, the cross-section of the door may define an arc of a circle.

10 Conveniently, said access means associated with the chamber may connect to the full-height area of the respective chamber and may be provided at or substantially at floor level.

In yet another aspect of the present invention there is provided a sleeping accommodation unit for a passenger vehicle, particularly an aircraft, 15 comprising:

a housing having two opposing side walls and two opposing end walls that define a recess;

20 two substantially identical, vertically spaced upper and lower bunks disposed within the recess, which bunks are substantially vertically aligned with one another and at least the upper bunks is disposed contiguous one of said side walls, thereby forming a horizontal partition across the recess and defining the full height region intermediate said bunks and the other side wall;

first substantially vertical partition means extending from the other side wall to the bunks thereby to partition the full height region into two juxtaposed 25 changing areas;

second substantially vertical partition means configured and arranged to partition one of the bunks from a respective one of the changing areas, such that the one changing area connects solely to the other bunk;

third substantially vertical partition means configured and arranged to partition the other of the bunks from the other changing area, such that the other changing area connects solely to the one bunk;

5 and access means associated with each of the changing areas adapted to allow users to gain access independently to each of the changing areas.

Preferably, said upper bunk is disposed contiguous both of the end walls. Each of said changing areas may accommodate a passenger seat.

In some embodiments, said upper bunk may be contiguous only one of said end walls, whereby said full-height region comprises a first portion that 10 extends intermediate said bunks and the other side wall and a second transverse portion that extends intermediate the bunks and the other end wall. Said first substantially vertical partition means may be positioned a symmetrically with respect to the bunks, closer to the other end wall than said one end wall, thereby forming a first changing area that is contained wholly within the first 15 portion of the full-height region and a second transverse changing area that comprises said second portion of the full-height region. Each of said changing areas may accommodate a passenger seat, and each seat may be arranged substantially parallel to the longitudinal axis of the bunks.

According to yet another aspect of the present invention there is 20 provided a sleeping accommodation unit for a passenger vehicle, particularly an aircraft, comprising:

a housing having two opposing side walls and two opposing end walls that define a recess;

25 two substantially identical, vertically spaced, upper and lower bunks disposed within the recess, which bunks are substantially vertically aligned with one another and at least the upper bunk is disposed contiguous one of said side walls, thereby forming a horizontal partition across the recess, and said upper and lower bunks are spaced from said side walls thereby defining two opposed,

full-height changing areas intermediate said bunks and said respective side walls;

5 first substantially vertical partition means extending between said end walls and upwardly from one side of the upper bunk thereby to partition said upper bunk from one of full height changing areas;

second substantially vertical partition means extending between said end walls and between said upper and lower bunks to the other side of the upper bunk, thereby to partition the lower bunk from the other of the changing areas,

10 and access means associated with each of the changing areas adapted to allow users to gain access independently to each of the changing areas.

In accordance with yet another aspect of the present invention there is provided a modular sleeping accommodation unit for a passenger vehicle, particularly an aircraft, comprising:

15 a first bunk module comprising two opposing side walls and two opposing end walls that define a recess;

two substantially vertically spaced, substantially identical, upper and lower bunks received within the recess, which bunks are substantially vertically aligned with one another and at least the upper bunk is contiguous said side and end walls of the bunk module, thereby horizontally partitioning the recess;

20 an upper opening formed in one of said side or end walls to allow access only to the upper bunk;

a lower opening formed in one of said side or end walls to allow access only to the lower bunk, which lower opening is horizontally spaced from said upper opening;

25 two changing area modules wherein each changing area module comprises wall means that define a full height changing area having an open end and access means adapted to allow the user to gain access to the changing area independently of the other changing area module;

wherein each of said changing area modules is disposed with its respective open end in abutment with the bunk module such that said open end connects to a respective one of said upper and lower openings, whereby a user using one of the changing area modules has exclusive access to a respective 5 one of the upper or lower bunks.

Both of said upper and lower openings may be formed in a side wall of the bunk module. Said upper and lower openings maybe formed in opposing side walls of the bunk modules. Alternatively, the upper and lower opening may be formed in the same side wall of the bunk module.

10 Each changing area module may accommodate a passenger seat.

Following is a description by way of example only with reference to the accompanying drawings of embodiments of the present invention.

In the drawings:

Figure 1 is an isometric side view of an accommodation unit according 15 to a first embodiment of the present invention.

Figure 1A is a partly cut-away isometric view from above of the accommodation unit of Figure 1.

Figures 2A, 2B & 2C are alternative cabin lay-outs incorporating a plurality of accommodation units in accordance with said first embodiment of 20 the invention.

Figure 3 is schematic isometric view of an accommodation unit according to a second embodiment of the present invention.

Figures 4A, 4B & 4C show cabin lay-outs incorporating the accommodation unit of the second embodiment.

25 Figure 5 is a schematic isometric view of an accommodation unit according to a third embodiment of the present invention.

Figures 6A & 6B show alternative cabin layouts incorporating a plurality of accommodation units according to the third embodiment.

Figure 7 is a schematic isometric view of an accommodation unit according to a fourth embodiment of the present invention.

Figures 8A, 8B & 8C show-alternative cabin layouts incorporating the accommodation unit of the fourth embodiment.

5 Figure 9 is an exploded, schematic, isometric view of a modular accommodation unit according to a fifth embodiment of the present invention.

Figure 9A is a partly cut-away schematic, isometric view of the accommodation unit of Figure 9 when assembled.

10 Figures 10A, 10B & 10C show alternative cabin layouts incorporating a plurality of modular accommodation units according to the fifth embodiment.

With reference to Figures 1 and 1A, an accommodation unit in accordance with the present invention comprises a generally cuboidal housing 10 that is formed as an integral, pre-fabricated structure from a robust, light-weight, composite material that is suitably flame- and fire-proof and is 15 approved for use on commercial passenger aircraft. Said housing comprises two opposing end walls 12, 14 and two opposing side walls 16, 18. The housing further comprises an integral roof 20 and a floor 22. The distance between said opposing end walls 12, 14 is at least about 183cm (6'), and may preferably be up to 2m (6'6"). As best seen in Figure 1, the housing defines 20 an interior space 24 that accommodates two substantially identical, vertically spaced bunks 30, 32. Said bunks occupy approximately half of the floor area of the housing and are positioned in vertical alignment with one another against one of the sidewalls 18 and both end walls 12, 14 such that the upper bunk 32 is contiguous said one side wall 18 and both end walls 12, 14. Said bunks 30, 25 32 are arranged in a "head-to-foot" arrangement within the housing 10 such that the head of one bunk 30, 32 is disposed adjacent one of the end walls 12, 14, and the head of the other bunk 32, 30 is disposed adjacent to the other end wall 14, 12. Said lower bunk 30 may be disposed at or substantially at floor

level or maybe elevated slightly on suitable supporting means, such for example, as legs or a plinth.

Said bunks 30, 32 define, with the other sidewall 16, a full height space within the housing 10. Said full-height space is divided approximately in half 5 by a first internal, substantially vertical partition (not shown) which extends from said other wall 16 to the bunks 30, 32 along a notional line (indicated by P in Figure 1A) across the internal space 24 approximately equidistant from the end walls 12, 14. Said first vertical partition serves to divide the full-height space into two adjacent changing areas 40, 42. One of said changing areas 40, 10 42 adjacent one of the end walls 12, 14 is partitioned from the lower bunk 30 by means of a second substantially vertical, rectangular partition 44 which extends between the one end wall 12, 14 and the first full height vertical partition and between the upper and lower bunks 30, 32. Said second rectangular partition 44 thus serves to isolate the one changing area 40, 42 15 from the lower bunk 30, whilst allowing access to the upper bunk 32. The other changing area 42, 40 adjacent the other end wall 14, 12 is partitioned from the upper bunk 32 by means of a similar third rectangular partition 46 that extends between the first vertical partition and the other end wall 14, 12 and between the upper bunk 32 and the top of the housing 10. Said third 20 rectangular partition 46 thus serves to isolate the other changing area 42, 40 from the upper bunk 32, whilst allowing access to the lower bunk 30.

The horizontal partitioning provided by bunk 32 and the first, second and third substantial vertical partitions 44, 46 thus serve to define two separate, non-connecting chambers, each of which contains a respective one of the bunks 25 30, 32 and a respective full-height changing area 40, 42 adjacent the respective bunk 30, 32.

Said other side wall 16 is formed with two juxtaposed doorways 50, 52 allowing independent access to the two changing areas 40, 42 respectively.

Over each doorway, 50, 52, said roof 20 is formed with two integrant protruding portions 52, 53. Each of said protruding portions 52, 53 has an outer edge 54 which follows a convex arc of a circle. Each doorway 50, 52 accommodates an arcuate rotatory door 60. Said door comprises a part-  
5 cylindrical panel 61 that extends between two substantially vertical, longitudinal, linear edges 62. In horizontal cross-section, the panel 61 follows an arc of a circle that has substantially same diameter and length as the convex outer edge 54 of each protruding portion 53 of the roof 20. The linear, horizontal distance between said longitudinal edges 62 is substantially equal to  
10 the width of the doorway 50, 52. The door 60 is mounted within the doorway 50, 52 on suitable mounting means for rotation about an axis that substantially coincides with the notional axis of rotation of the part-cylinder forming the door 60 such that the path of the door substantially coincides with the arcuate outer edge 54 of the roof 20. Any suitable means known to those skilled in the  
15 art may be used for mounting the door 60 to the housing 10; for instance, runners (not shown) may be provided on the upper edge 63 of the door which engage in and run along an arcuate track (not shown) provided in the underside of the protruding portion 53 of the roof 20 adjacent the arcuate outer edge 54. A corresponding arcuate track 64 may be provided in the floor of the vehicle  
20 adjacent the housing 10, or in a protruding portion of the floor 22, to accommodate runners (not shown) fitted to the bottom edge 65 of the door.

The door 60 is capable of movement between an open position as shown in Figure 1 in which the door 60 defines a passageway with the doorway 50, 52 to allow access to the respective changing area 40, 42, and two alternative closed positions. In a first "occupied" closed position as shown in Figure 1A, the door is positioned such that it extends outwardly of the housing 10 in order to enlarge the internal volume of the respective changing area, 40, 42. In a second "vacant" closed position, the door is concave when viewed  
25

from outside; that is that it extends into the housing 10 in order to reduce the volume occupied by the accommodation unit when not in use. Suitable locking means may be provided at the door 60 and an associated door jam 51 to enable a passenger to lock the door 60 at least in the first closed position from inside  
5 the compartment.

The accommodation unit 10 according to the first embodiment of the present invention can be incorporated into a cabin layout in a vehicle such as an aircraft in numerous different ways. Three alternative cabin layouts are shown in Figures 2A, 2B and 2C. According to Figures 2A and 2C, a plurality  
10 of accommodation units 10 may be positioned within a cabin against an outside wall of the cabin such that the doors 60 face inwardly to define an aisle 70. A number of reclinable passenger seats 80, corresponding to the total number of bunks provided by the accommodation units 10, may also be provided in the cabin in the vicinity of the accommodation units 10 to provide seating for the  
15 passengers when they are not using their respective accommodation units 10. As shown in Figure 2B, the accommodation units 10 may be provided in pairs, with the accommodation units 10 within each pair being arranged back to back. The pairs of accommodation units 10 may be suitable spaced to provide mini-aisles 90 therebetween to allow access to all of the doors 60. As with the  
20 layout shown in Figures 2A and 2C, a number of reclinable passenger seats 80 corresponding to the total number of bunks provided may be disposed in the vicinity of the accommodation units 10 for passengers when not using their respective bunks.

A second embodiment of an accommodation unit in accordance with the  
25 present invention is shown in Figure 3. The accommodation unit 100 illustrated in Figure 3 is in many respects the same as the accommodation unit 10 of Figures 1 and 1A and so the following description of the accommodation unit 100 of the second embodiment focuses in the main on features which are

- different from the accommodation unit 10 of the first embodiment. As with the accommodation unit 10 of the first embodiment, the second embodiment accommodation unit comprises a generally cuboidal housing 110 comprising two opposing end walls 112, 114 and two opposing side walls 116, 118. The 5 housing 110 thus defines an interior space 124 that accommodates two substantially identical, vertically spaced upper and lower bunks 130, 132. Said bunks 130, 132 are disposed contiguous one of the side walls 118 and both end walls 112, 114 to define two juxtaposed changing areas 140, 142 that are partitioned from each other by a first, substantially vertical, full-height 10 rectangular partition 141. Second and third, substantially vertical, rectangular partitions 144, 146 are provided for partitioning each of the full-height changing areas 140, 142 from a respective one of the bunks 130, 132 to define two separate non-connecting chambers. According to the second embodiment, the width of each full-height changing area 140, 142 in the direction between 15 the two side walls 116, 118 is greater than in the first embodiment to provide sufficient space to accommodate a passenger seat 180. As shown in Figure 3, said passenger seats 180 may face towards their respective bunks 130, 132. The housing 110 is provided with two entrances (not shown) associated with the two changing areas 140, 142 respectively. Although not shown, each of 20 said changing areas 140, 142 may be provided with a rotatory door 60 of the kind described above in relation to the first embodiment. In view of the increased width of the changing areas 140, 142 the respective doorways maybe positioned in the other side wall 116, as is the case in the first embodiment, or alternatively in the adjacent end wall 112, 114.
- 25 Three alternative cabin layouts incorporating the accommodation units 100 in accordance with the second embodiment are shown in Figures 4A, 4B and 4C. As shown in Figure 4A, three accommodation units 100A are arranged contiguously along the centre axis of an aircraft cabin in a front-to-

front, back-to-back configuration with access to each of the changing areas 140, 142 being provided through an end wall 112, 114 of the respective accommodation unit 100A. Two further accommodation units 100B are arranged with their respective end walls 112, 114 against the side walls of the aircraft cabin. In each case, access to an outboard changing area 140, 142 adjacent to a cabin wall is provided through a sidewall 116 of the accommodation unit 100B whilst access to the inward changing area 140, 142 is provided by a door formed in either the side wall 16 or the end wall 114, 112, that is remote from the cabin wall. As each accommodation unit 100A, 100B includes two passenger seats, one associated with each bunk 130, 132 there is no need to provide additional seating outside the accommodation units.

Figure 4B shows a cabin layout in which five accommodation units 100C are arranged contiguously along the centre axis of an aircraft cabin in a front-to-back configuration, with access to each changing area 140, 142 of each unit 100C being provided through an end wall 112, 114.

In Figure 4C, five accommodation units 100D are arranged contiguously against a side wall of an aircraft cabin in side-to-side arrangement, and access to each changing area 140, 142 is provided through a side wall 116 on each accommodation unit 100D.

As may be seen from Figures 4A, 4B and 4C, the upper and lower bunks of each accommodation unit 100 may be trapezoidal having substantially parallel end edges 133, 134 (see Figure 4B) and a first side edge 135 that is square to the end edges 133, 134 and is disposed contiguous the one side wall 118 of the unit 100, and a second longitudinal side edge 136 that is slanted with respect to the first side edge 135 to provide a relatively wide head end and a narrow foot end. As mentioned above, the upper and lower bunks are arranged relative to each other in a head-to-foot arrangement, so the narrow foot end of the upper bunk will be disposed over the wide head end of the

lower bunk, and the wide head end of the upper bunk will be disposed over the narrow foot end of the lower bunk. As will be apparent to those skilled in the art, such an arrangement will mean that the second and third substantially vertical partitions 144, 146 are not in fact absolutely vertical relative to the 5 floor of the aircraft but will be inclined slightly so as to extend between the narrow end of one bunk 130, 132 and the wide end of the other bunk 132, 130.

Figure 5 shows a third embodiment of an accommodation unit 200 comprising a substantial cuboidal housing 210 having two opposing end walls 212, 214 and two opposing side walls 216, 218, and a roof 220 and a floor 10 222. Said housing 200 thus defines an internal space 224 which accommodates two upper and lower bunks 230, 232 as before. A first substantially vertical, rectangular partition 241 is provided to divide the interior space 224 vertically into two juxtaposed changing areas 240, 242, each of which is associated with a respective one of the bunks 230, 232. Said bunks 230, 232 are disposed 15 contiguous one of the side walls 218 and, according to the third embodiment, contiguous only one of the end walls 212. Said bunks 230, 232 are spaced from the other side wall 218, and from the other end wall 214. Unlike the accommodation units 10, 100 of the first and second embodiment as described above, the first partition 241 in the third embodiment is positioned off-centre, 20 closer to said other end wall 212. One of the full-height changing areas 240 is thus formed wholly between the bunks 230, 232 and the other side wall 216, while the other full-height changing area 242 includes a transverse full-height region 243 that extends between the bunks 232, 230 and the other end wall 214 and occupies the whole width of the unit 200 between the two side walls 216, 218. Thus, although the other changing area 242 is shorter than the one 25 changing area 240 in the direction between the two end walls 212, 214, it includes additional space at the ends of the bunks 230, 232 intermediate the other end wall 214. As with the second embodiment, each changing area 240,

242 of the unit 200 of the third embodiment includes a passenger seat 280 which, in the third embodiment, is positioned parallel to the longitudinal axis of the bunks 230, 232. Preferably, each of the seats 280 can be reclined, and in a reclined position, the seat 280 in the other changing area 242 may extend 5 into the transverse full-height region 243.

Said one changing area 240 is partitioned from one of the bunks 230, 232 by a second, substantially vertical, rectangular partition 244, to isolate the one changing area 240 from that bunk 230, 232, whilst the other changing area 240 is partitioned from the other bunk 232, 230 by a third substantially 10 vertical, L-shaped partition that extends along the side and across the end of the other bunk 232, 230. As shown in Figure 5, the one changing area 240 is divided from the upper bunk 232 to allow access only to the lower bunk 230, although it will be evident to those skilled in the art that the one changing area 240 could alternatively be partitioned from the lower bunk 230.

15 Possible cabin layouts incorporating the accommodation unit 200 of the third embodiment as shown in Figures 6A & 6B. As can be seen, in each case, a plurality of accommodation units 200 are positioned against the cabin walls of an aircraft, with access to each of the changing areas 240, 242 being provided through the other side wall 216 of each unit 200.

20 Figure 7 shows a fourth embodiment of an accommodation unit in accordance with the present invention. Said accommodation unit 300 in accordance with the fourth embodiment comprises a generally cuboidal housing 310 having two opposing end walls 312, 314 and two opposing side walls 316, 318, and a roof 320 and a floor 322. The housing 310 thus defines an interior 25 space 324 which accommodates two substantially similar, vertically spaced upper and lower bunks 330, 332. Each of said bunks 330, 332 abuts and is contiguous with each of the said end walls 312, 314, and is spaced from each of the side walls 316, 318 to define two spaced, full-height changing areas 240,

242 juxtaposed the two side walls 316, 318 respectively. Said upper bunk 332 serves to partition the interior space 324 horizontally; and the interior space 324 is partitioned vertically by two vertically and horizontally spaced, substantially vertical, rectangular, upper and lower partitions 343, 346. The 5 lower partition 346 extends to one side of the bunks 330, 332 between said upper and lower bunks, and the upper partition 344 extends to the other side of the bunks 330, 332 between the upper bunk 332 and the roof 320. The two full-height changing areas 340, 342 are thus partitioned from each other, and each accommodates a passenger seat 380. Access to each passenger 10 compartment is provided through a separate entrance associated with each changing area 340, 342, and although not shown a rotatory door of the kind described with reference to the first embodiment above may be used. Three cabin layouts incorporating accommodation units 300 in accordance with the fourth embodiment are shown in Figures 8A, 8B and 8C. In Figure 8A, three 15 accommodation units 300A are positioned along the centre axis of the aircraft cabin, while two further accommodation units 300B are arranged side by side symmetrically about the said centre axis and spaced from the side walls of the cabin.

In Figure 8B, five accommodation units 300A are arranged contiguously 20 along the centre axis of an aircraft cabin, and in Figure 8C, five accommodation units 300C are disposed against a side wall of the aircraft cabin, with an end wall 314 of each unit 300C towards said cabin side walls. In Figure 8C, a number of additional passenger seats 382 corresponding to the total number of bunks are provided for use by passengers when they do not 25 wish to be seated or asleep in their respective accommodation units 300C.

Figures 9 and 9A show a modular accommodation unit 400 in accordance with a fifth embodiment of the invention. Said modular accommodation unit 400 which is shown in exploded form in Figure 9

comprises a bunk module 410 and two changing-area modules 460. Said bunk module 410 comprises two opposing substantially planar upright end walls 412, 414 and two opposing, arcuate, convex side walls 416, 418. Said bunk module 410 further comprises a roof 420 and a floor 422. As with the first 5 embodiment, the modular accommodation unit 400 of the fifth embodiment may be manufactured from any suitable light-weight, flame and fire-proof, robust structural composite material that is authorised by the aviation authorities for use on commercial passenger aircraft.

Said bunk module 410 accommodates two substantially similar, 10 vertically spaced, upper and lower bunks 430, 432. Each of said bunks 430, 432 is at least 183cm (6') long between the two end walls 412, 414, and is at least 76cm (2'6") preferably at least 91cm (3'), wide between the two opposed side walls 416, 418 at the widest point.

Said bunk module 410 is thus partitioned horizontally by the upper 15 bunk 432, and each bunk is surrounded by the end and side walls 412, 414, 416, 418. One of said end and side walls is provided with a generally rectangular inner cut-out portion 434 to provide access to the top bunk 432. In Figures 9 and 9A, one of the side walls 418, is cut out at 434 although, as mentioned above, either of the side walls 416, 418 or end walls 412, 414, may 20 be cut-out to provide access to the top bunk 432. Similarly, one of the side and end walls 412, 414, 416, 418, is provided with a lower rectangular cut-out portion 436 to provide access to the bottom bunk 430. Again, the cut-out portion 436 may be provided in any of the side or end walls, but, in the embodiment shown in Figures 9 and 9A the one side wall 418 is formed with 25 both upper and lower cut-outs 434, 436. Said cut-out portions 434, 436 are horizontally and vertically spaced from each other and the first cut-out portion 434 provides access only to the upper bunk 432, while the second cut portion 436 provides access only to the lower bunk 430.

Each of said changing area modules 460 comprises an integral unit having an end wall 462, two opposing arcuate side walls 464 and an integral roof portion 465. Each changing area module 460 thus defines an interior space 470 having an open end 472 that generally opposes the end wall 462.

- 5      The interior space 470 of each changing area module 460 accommodates a passenger seat 480 and is provided with a doorway 450 in one of the opposing side walls 464 to provide access to the interior space 470. Said doorway 450 is provided with a suitable door (not shown) such as a rotatory door as the kind described above with reference to the first embodiment.
- 10     Each changing-area module 460 is positioned with its open end 472 in abutment with the bunk module 470 to cover a respective one of the upper and lower cut-out portions 434, 436, thereby to close the bunk module 410 and to allow access from the interior space 470 of the changing area module 460 into a respective one of the bunks 430, 432 in the bunk module 410. As mentioned 15    above, in the embodiment shown in Figures 9 and 9A, both cut-out portions 434, 436 are formed in one side wall 418 of the bunk module 410, and accordingly the side walls 464 and roof 465 of each changing-area module 460 are suitably configured to mate contiguously with the one arcuate side wall of the bunk module 410. In particular, it will be seen from Figures 9 and 9A that 20    the roof portion 465 of each changing area module 460 has an arcuate front edge 466.

When assembled, the modular accommodation unit 400 in accordance with the fifth embodiment of the present invention provides a passenger with a private changing area 470 to which the passenger can access through said doorway 25    450, and which allows exclusive access to a respective one of the bunks 430, 432 in the bunk module 410.

Figures 10A, 10B and 10C show three possible different cabin layouts incorporating the modular accommodation unit 400 of the fifth embodiment.

In Figure 10A, five modular accommodation units 400A are positioned adjacent the side walls of an aircraft cabin. In each case the bunk module 410 is positioned against the cabin side wall, and two changing-area modules 460 are positioned inwardly of the bunk module 410 against one side wall of the bunk 5 module 410.

In Figure 10B, five modular accommodation units 400B are positioned within an aircraft cabin such, that in each case, the bunk module 410 is positioned with one of its end walls 412, 414 against the side wall of the cabin. The changing-area modules 460 of each accommodation unit 400B are 10 positioned against opposing side walls 416, 418 of the bunk module 410.

In Figure 10C, five modular accommodation units 400C are arranged along the central longitudinal axis of an aircraft cabin in an echelon formation in which the longitudinal axis of the bunk module 460 of each accommodation unit 400C subtends an acute angle with the longitudinal axis of the cabin.

As with the cabin layout shown in Figure 10B, the two changing-area 15 modules 460 associated with each bunk module 410 are positioned against opposing side walls 416, 418 of the bunk module 410. As can be seen from Figure 10C, the changing-area modules 460 for each accommodation unit 400C are oriented such that the passenger seat 480 accommodated within each 20 changing-area module 460 is aligned substantially parallel to the longitudinal cabin axis with the open side 466 of each changing-area module 460 being positioned accordingly.

The accommodation units of the present invention thus provide an integral or modular construction in which two passenger berths are arranged 25 one above another in an efficient use of space in a vehicle cabin such, for example, as an aircraft cabin. Each of the upper and lower bunks is associated with a juxtaposed, full-height changing-area to form a passenger cabin, and within each accommodation unit, the two cabins are full separated from each

other by suitable partitions to provide complete privacy for each passenger and are provided with separate entrances. The use of a rotatory door in accordance with the present invention allows the interior space of each passenger cabin to be maximised when in use and minimised when not in use, whilst minimising  
5 the volume occupied by the accommodation unit when not in use.

**Claims**

1. An accommodation unit for a passenger vehicle, particularly an aircraft, which accommodation unit comprises an housing defining an interior space, two bunks accommodated within said space in vertically spaced relation to each other, internal partition means for partitioning said interior space into two separate, non-connecting chambers, each of said chambers containing a respective one of said bunks and enclosing a full-height area juxtaposed the respective bunk, and separate access means associated with each chamber to provide separate entrances to the chambers.
10. 2. An accommodation unit as claimed in claim 1, wherein said bunks are substantially the same shape and size and are vertically substantially aligned with one another.
3. An accommodation unit as claimed in claim 1 or claim 2, wherein the access means associated with each chamber connect to the full-height area of the respective chamber and are provided at floor-level.
15. 4. An accommodation unit as claimed in claim 1, claim 2 or claim 3, comprising a top bunk and a bottom bunk.
5. An accommodation unit as claimed in claim 4, wherein the top bunk is at least partly supported by the housing.
20. 6. An accommodation unit as claimed in claim 4 or claim 5, wherein the top bunk is disposed contiguous an internal surface of the housing for horizontally partitioning the two chambers.
7. An accommodation unit as claimed in claim 6, further comprising vertical partition means for vertically partitioning the chambers from each other
25. 8. An accommodation unit as claimed in claim 7, wherein said top bunk comprises two opposing longitudinal sides and two opposing ends.
9. An accommodation unit as claimed in claim 8, wherein one of the longitudinal sides is contiguous an internal surface of the housing.

10. An accommodation unit as claimed in claim 8, wherein both of the longitudinal sides are contiguous an internal surface of the housing.
11. An accommodation unit as claimed in claim 9, wherein one of the ends of the top bunk is contiguous an internal surface of the housing.
- 5 12. An accommodation unit as claimed in claim 8, wherein both of the ends of the top bunk are contiguous an internal surface of the housing.
13. An accommodation unit as claimed in claim 9 or claim 11, wherein said full height areas are disposed adjacent one another to the other longitudinal side of the top bunk, and said vertical partition means comprise first dividing  
10 means for dividing the full height areas from each other, and second dividing means for dividing the bunk of each chamber from the full height area of the other chamber.
14. An accommodation unit as claimed in claim 12, wherein said full-height areas are disposed to opposing sides of the bunks and said vertical  
15 partition means comprise first and second, horizontally and vertically spaced, substantially vertical partitions disposed respectively to opposing sides of the bunks for vertically partitioning the bunk of each chamber from the full-height area of the other chamber.
15. An accommodation unit as claimed in any of claims 1 - 12, wherein  
20 said housing comprises a bunk module that accommodates said two bunks and two separate, full height changing modules that are each adapted to be fixedly secured adjacent said bunk module, wherein the bunk module comprises wall means that completely surround the two bunks except for two vertically spaced openings that provide access to each of the bunks respectively, and each of said  
25 full-height changing modules comprises wall means that surround and define a respective full-height area and define an open end that is adapted to butt against the bunk module to close the respective chamber and to connect with a respective opening to allow access from the full-height area to the respective

bunk; each of said full-height modules further comprising access means to allow access to the respective chamber.

16. An accommodation unit as claimed in any preceding claim, wherein said access means comprise means defining a doorway and an arcuate, rotatory door that is mounted in said doorway for rotation about a first axis between a first occupied closed position and a second vacant closed position through a third intermediate open position, said door having an arcuate cross-section in a plane orthogonal to the first axis, the arrangement being such that in the first occupied closed position, the door closed the doorway and protrudes from outwardly of the doorway, thereby enlarging the volume of the respective chamber; in the second vacant closed position the door closes the doorway and protrudes into the respective chamber, thereby reducing the volume occupied by the accommodation unit; and in the third open position, the door defines a passageway with the doorway to allow access to the chamber.
17. An accommodation unit as claimed in claim 16, wherein said first axis is substantially vertical, and said rotatory door is arcuate in a horizontal plane.
18. An accommodation unit as claimed in claim 16 or claim 17, wherein said cross-section of the door defines the arc of a circle.
19. An accommodation unit as claimed in any preceding claim, wherein said accommodation unit further comprises a roof.
20. An accommodation unit as claimed in any preceding claim, wherein said accommodation unit further comprises a floor.
21. A sleeping accommodation unit for a passenger vehicle, particularly an aircraft, comprising:
  - 25 a housing having two opposing side walls and two opposing end walls that define a recess; two substantially identical, vertically spaced, upper and lower bunks disposed within said recess, which bunks are substantially vertically aligned

with one another and at least the upper bunk is disposed contiguous one of said side walls, thereby forming a horizontal partition across the recess and defining a full height region intermediate said bunks and the other side wall;

5 first substantially vertical partition means extending from said other side wall to said bunks thereby to partition said full height region into two juxtaposed changing areas;

second substantially vertical partition means configured and arranged to partition one of the bunks from a respective one of the changing areas, such that the one changing area connects solely to the other bunk;

10 third substantially vertical partition means configured and arranged to partition the other of the bunks from the other changing area, such that the other changing area connects solely to the one bunk;

and access means associated with each of the changing areas adapted to allow users to gain access independently to each of the changing areas.

15 22. A sleeping accommodation unit as claimed in claim 21, wherein said bunks are contiguous both of said end walls.

23. A sleeping accommodation unit as claimed in claim 21 or claim 22, wherein each of said changing areas accommodates a passenger seat.

24. A sleeping accommodation unit as claimed in claim 21, wherein said 20 bunks are contiguous only one of said end walls, whereby said full height region comprises a first portion that extends intermediate said bunks and the other side wall and a second transverse portion that extends intermediate said bunks and the other end wall.

25. A sleeping accommodation unit as claimed in claim 24, wherein said first substantially vertical partition means is positioned asymmetrically with respect to the bunks and closer to the other end wall than the said one end wall, thereby forming a first changing area that is contained wholly within the first portion of the full height region and a second changing area that comprises

said second portion of the full height region.

26. A sleeping accommodation unit as claimed in claim 25, wherein each of said changing areas accommodates a passenger seat, wherein each of said seats is arranged substantially parallel to the longitudinal axis of the bunks.

5 27. A sleeping accommodation unit for a passenger vehicle, particularly an aircraft, comprising:

an housing having two opposing side walls and two opposing end walls that define a recess;

10 two substantially identical, vertically spaced, upper and lower bunks disposed within said recess, which bunks are substantially vertically aligned with one another and at least the upper bunk is disposed contiguous said end walls, thereby forming a horizontal partition across the recess, and said upper and lower bunks are spaced from said side walls, thereby defining two opposed full height changing areas intermediate said bunks and said respective side 15 walls;

first substantially vertical partition means extending between said end walls and upwardly from one side of the upper bunk, thereby to partition said upper bunk from one of said full height changing areas;

20 second substantially vertical partition means extending between said end walls and between said upper and lower bunks to the other side of said upper bunk, thereby to partition said lower bunk from the other of the changing areas; and access means associated with each of the changing areas adapted to allow users to gain access independently to each of the changing areas.

28. A modular sleeping accommodation unit for a passenger vehicle, 25 particularly an aircraft, comprising:

a first bunk module comprising two opposing side walls and two opposing end walls that define a recess;

two substantially vertically spaced, substantially identical, upper and

lower bunks received within said recess, which bunks are substantially vertically aligned with one another and at least said upper bunk is disposed contiguous said side and end walls of the bunk module, thereby horizontally partitioning said recess;

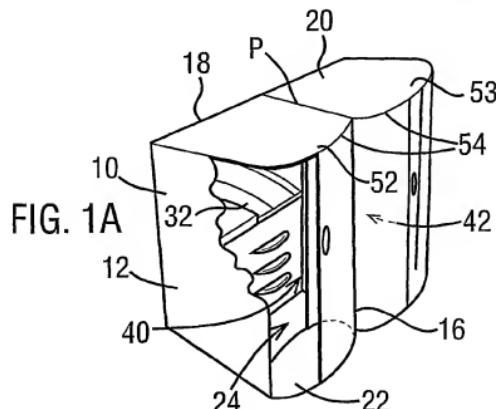
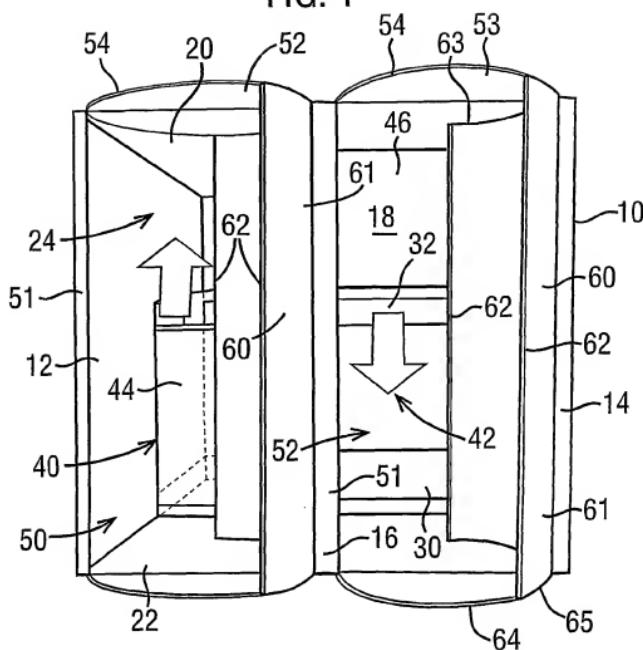
- 5        an upper opening formed in one of said side or end walls to allow access only to the upper bunk;
- a lower opening formed in one of said side or end walls to allow access only to the lower bunk, which lower opening is horizontally spaced from said upper opening;
- 10      two changing area modules, wherein each changing area module comprises two opposing side walls and an end wall that together define a full-height changing area having an open end opposing said end wall, and access means adapted to allow a user to gain access to said changing area independently of the other changing area module;
- 15      wherein each of said changing area modules is disposed with its respective open end in abutment with the bunk module such that said open end connects to a respective one of said upper and lower openings, whereby a user using one of the changing area modules has exclusive access to a respective one of the upper or lower bunks.
- 20      29. A modular sleeping accommodation unit for a passenger vehicle as claimed in claim 28, wherein both of said upper and lower openings are formed in a side wall of the bunk module.
30. A modular sleeping accommodation unit for a passenger vehicle as claimed in claim 28 or claim 29, wherein said upper and lower openings are formed in opposing side walls of the bunk module.
- 25      31. A modular sleeping accommodation unit for a passenger vehicle as claimed in claim 28 or claim 29, wherein said upper and lower openings are formed in the same side wall of the bunk module.

30

32. A modular sleeping accommodation unit for a passenger vehicle as claimed in any of claims 28 - 31, wherein each changing area module accommodates a passenger seat.

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FIG. 1



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FIG.2A

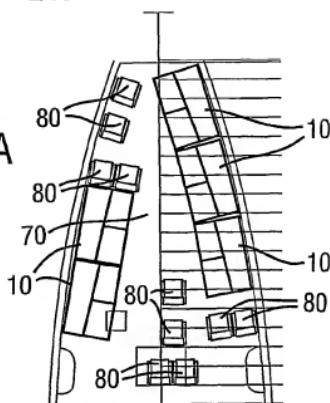


FIG.2B

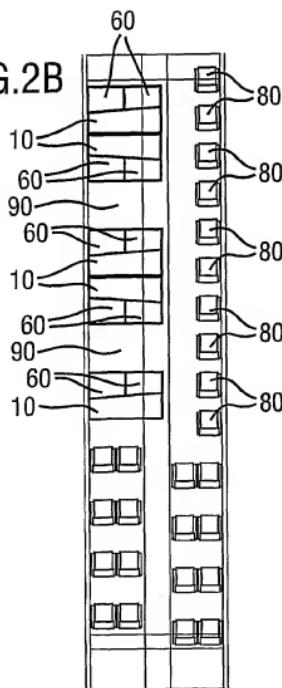
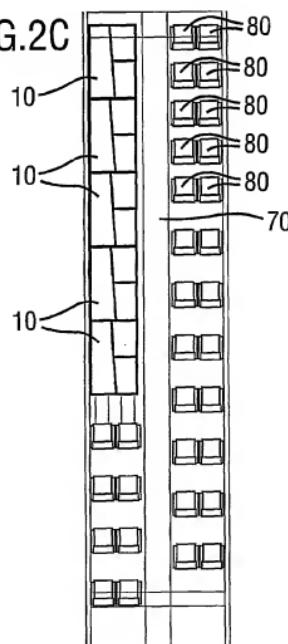


FIG.2C



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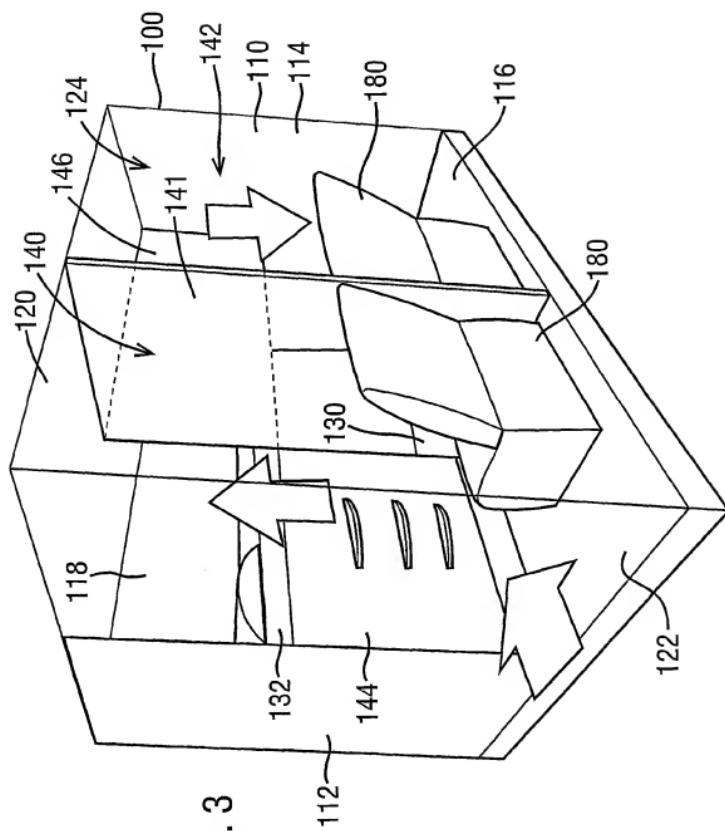


FIG. 3

FIG.4A

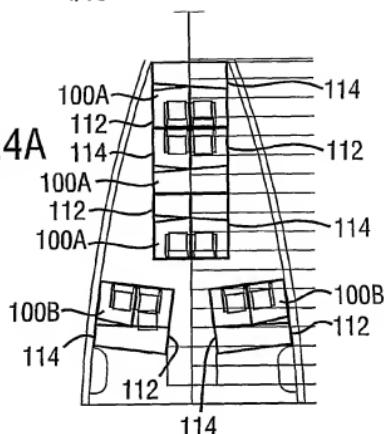


FIG.4B

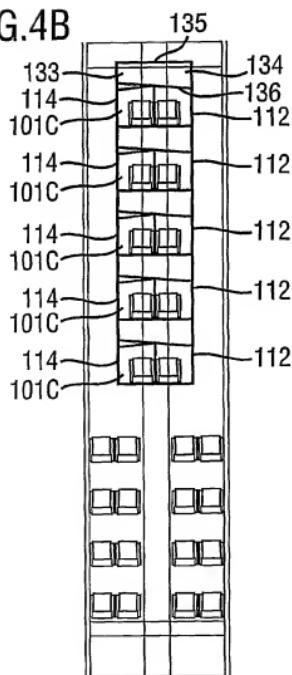
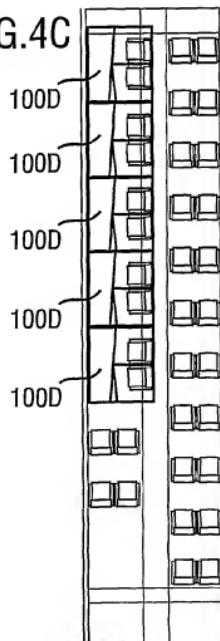
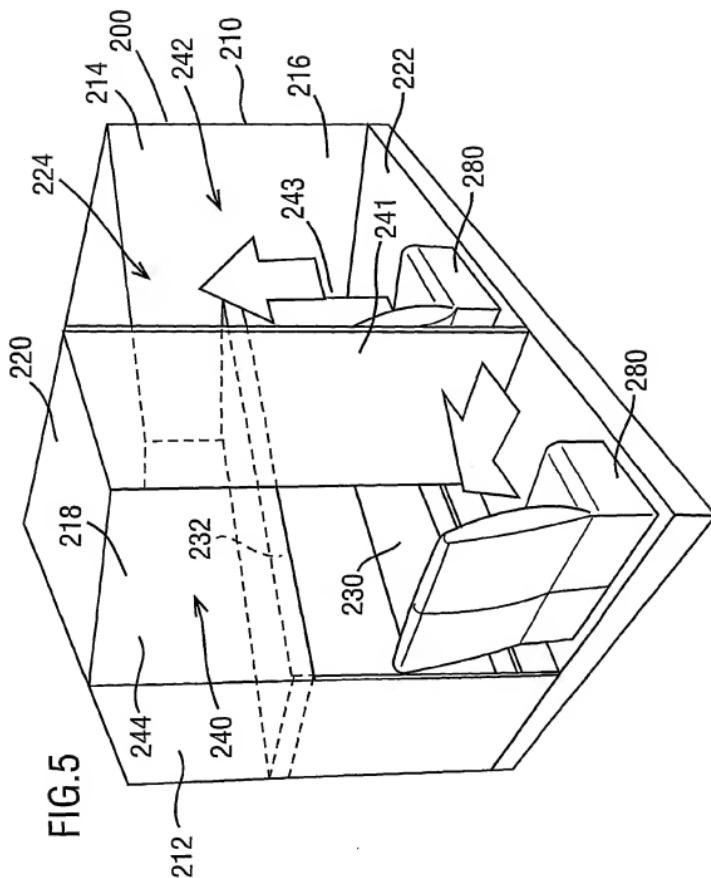


FIG.4C



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FIG.6A

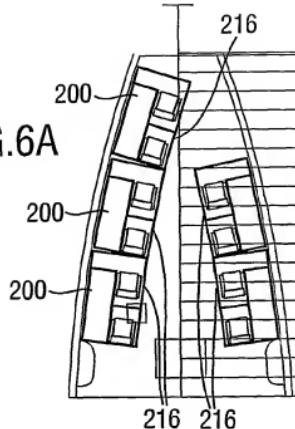
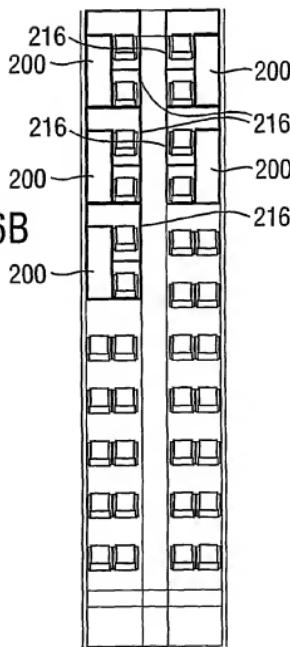
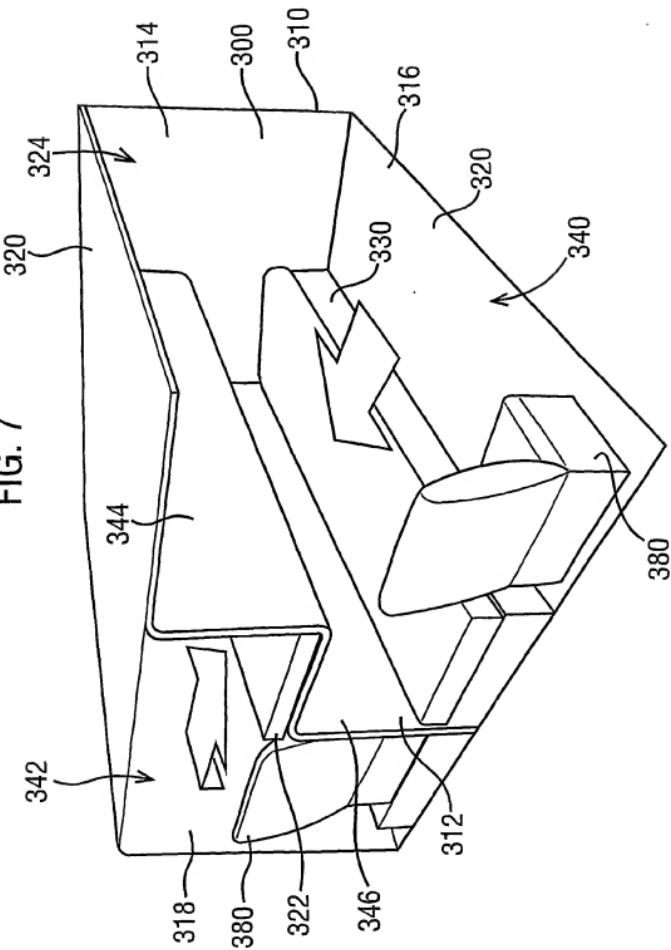


FIG.6B



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FIG. 7



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FIG.8A

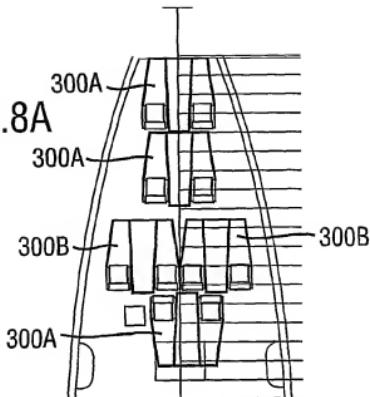


FIG.8B

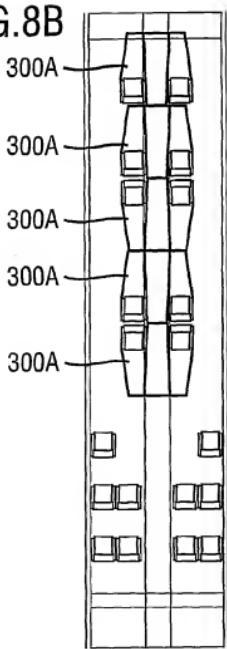
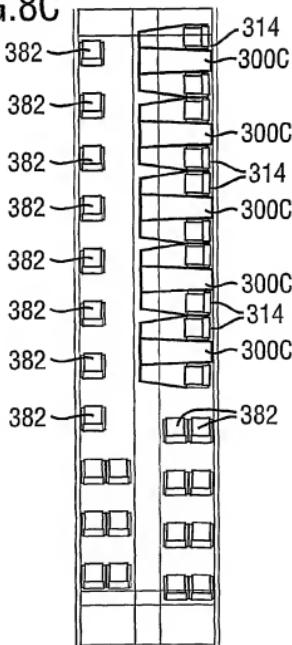


FIG.8C



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FIG.9A

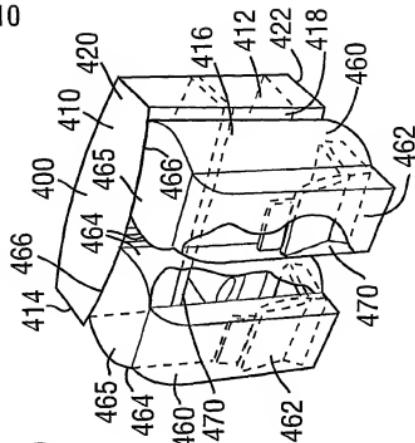
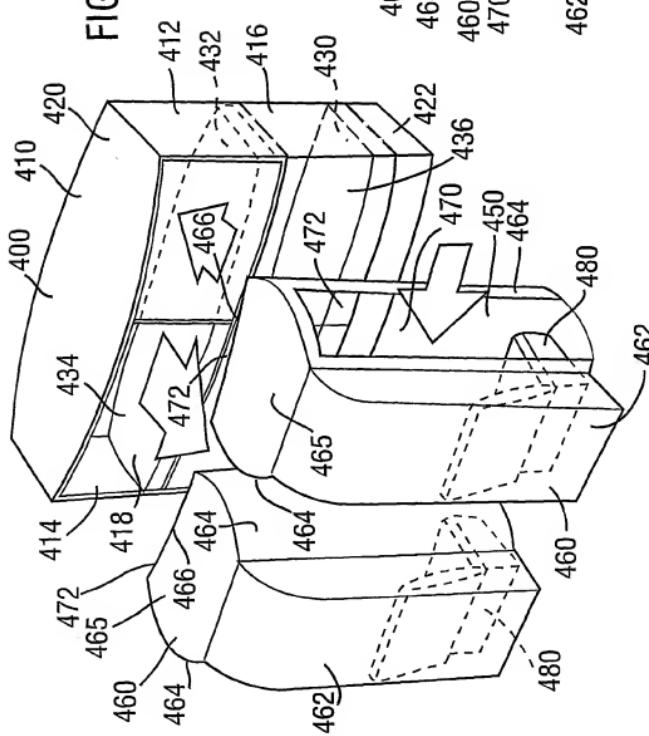


FIG.9



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FIG.10A

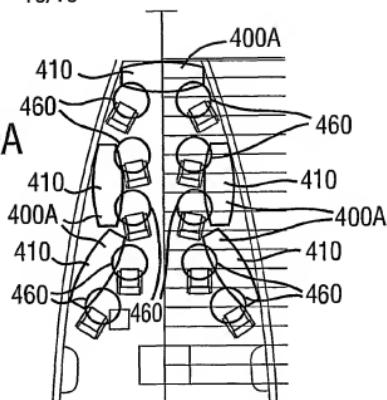


FIG.10B

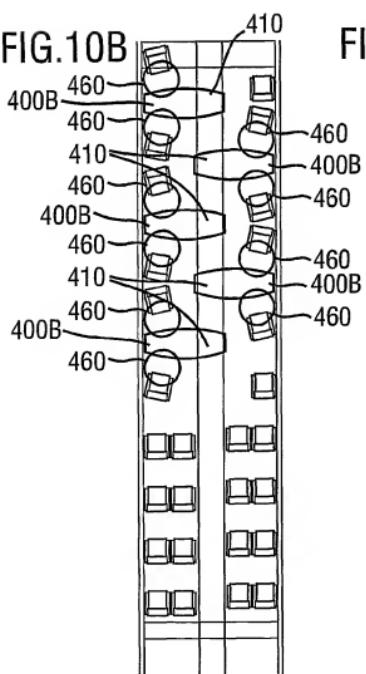
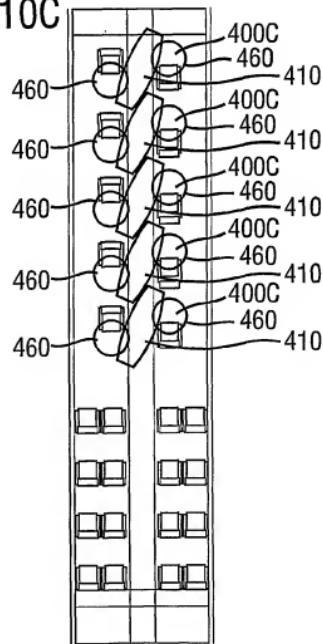


FIG.10C



## INTERNATIONAL SEARCH REPORT

Int	Application No
PCT/GB 01/04397	

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 B64D11/00 B61D31/00 B63B29/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 B64D B61D B63B B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 256 857 A (DUMAS ROGER) 1 August 1975 (1975-08-01) page 1, line 29 - line 38	1-5,20, 21,27,28
A	GB 727 654 A (CIE INTERNATIONALE DES WAGONS) 6 April 1955 (1955-04-06) the whole document	1,21,23, 27,28,32
A	US 2 628 366 A (MICHAEL WATTER) 17 February 1953 (1953-02-17) the whole document	1,21,27, 28
A	GB 598 859 A (RALPH MARSHALL) 27 February 1948 (1948-02-27) the whole document	1,21,27, 28
		-/-

Further documents are listed in the continuation of box C.

Patient family members are listed in annex.

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- \*X\* document of particular relevance; the claimed invention cannot be considered novel or can only be considered to involve an inventive step when the document is taken alone
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Date of the actual completion of the international search

20 November 2001

Date of mailing of the international search report

26/11/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL-2280 HV Rijswijk  
 Tel. (+31-70) 340-2640, Tx. 31 651 epo nl,  
 Fax. (+31-70) 340-3016

Authorized officer

Hauglustaine, H

## INTERNATIONAL SEARCH REPORT

Int

Application No

PCT/GB 01/04397

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2 884 873 A (CANDLIN JR JAMES E) 5 May 1959 (1959-05-05) the whole document -----	1,21,27, 28

INTERNATIONAL SEARCH REPORT  
SEARCHED ON PCT/GB 01/04397Ir Application No  
PCT/GB 01/04397

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GB 598859	A	27-02-1948	NONE			
US 2884873	A	05-05-1959	NONE			